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Barite Hill/Nevada Goldfields
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AL QUALITY ASSURANCE PROJECT PLAN

FOR

BARITE HILL GOLD MINE SITE
MCCORMICK, SOUTH CAROLINA

U.S. EPA Work Assignment No.: 0-247
Lockheed Martin Work Order No.: EAC00247
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Prepared For:
United States Environmental Protection Agency/Environmental Response Team
Edison, NJ

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Approved By:

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A. PROJECT MANAGEMENT

This Quality Assurance Project Plan (QAPP) was prepared in accordance with *EPA Requirements for Quality Assurance Project Plans (QAPPs)*, *EPA QA/R5*, and the *Response, Engineering, and Analytical Contract (REAC) Program QAPP*.

A3. DISTRIBUTION LIST

The following personnel will receive copies of the approved QAPP for the Barite Hill Goldmine Site, Work Assignment (WA) No. 0-247.

1. Don Bussey, Environmental Protection Agency/Environmental Response Team (EPA/ERT) Work Assignment Manager (WAM)
2. Scott Fredericks, EPA/ERT
3. Greg Powell, EPA/ERT
4. Ed Bates, EPA Office of Research and Development (ORD)
5. Richard Henry, United States Fish and Wildlife Services (USFWS)
6. Leo Francendese, EPA Region IV On Scene Coordinator (OSC)
7. Dennis Miller, REAC Program Manager
8. Deborah Killeen, REAC Quality Assurance Officer (QAO)
9. Parry Bhambra, REAC Operations Section Leader
10. Jon McBurney, REAC Task Leader (TL)/Quality Control (QC) Coordinator

A4. PROJECT ORGANIZATION

The following individuals will participate in the project:

EPA/ERT

Don Bussey - WAM
Scott Fredericks - ERT
Greg Powell - ERT
William Coakley - Quality Assurance (QA) Manager

EPA Region IV

Leo Francendese - OSC

EPA ORD

Ed Bates

USFWS

Richard Henry

REAC

Jon McBurney - TL/QC Coordinator
Chris Gussman - Environmental Scientist
Brian Holderness - Environmental Engineer
Scott Grossman - Environmental Scientist
Michael Nigro - Environmental Technician
Amy Dubois - Air/Field Scientist
Deborah Killeen - QAO
Dan Patel - Engineering Group Leader

The EPA Region IV will designate a Contract Laboratory Program (CLP) laboratory that will receive soil, sediment and water samples for Target Analyte List (TAL) metals, total cyanide and weak acid dissociable (WAD) cyanide.

The REAC TL/QC Coordinator for the project is the primary point of contact with the EPA/ERT WAM. The TL is responsible for the completion of the Work Plan (WP) and QAPP, project team organization, and supervision of all project tasks, including reporting and deliverables.

A5. PROBLEM DEFINITION/BACKGROUND

The Barite Hill Gold Mine is an inactive gold mine located approximately three miles south of McCormick, South Carolina (SC). The mine actively mined gold from 1991 to 1995. Between 1995 and 1999, the site was undergoing reclamation activities under the direction of Nevada Goldfields. In 1999, Nevada Goldfields filed for bankruptcy and the site was given to the South Carolina Division of Health and Environmental Control (SCDHEC).

The Site is located along a topographic high ridge area forming the headwaters of an unnamed tributary to Hawes Creek. The topography of the area consists of rolling hills with ridgelines at an elevation of approximately 510 feet. The permitted mine site totals 795.2 acres of which 659.7 acres are designated as buffer area.

The facility used a cyanide solution in a heap leach process to extract gold from ore. Pursuant to this method of extraction, there are three major waste rock piles contaminated with cyanide, seven processing ponds, several processing building with associated piping, and the large Main Pit from which the ore was mined. The Main Pit is now filled with pH 2 to 2.2 water with a high dissolved metal content. The surrounding rock contains a large amount of Barite (BaSO_4) and Pyrite (FeS_2). The weathering of the pyrite has depressed the pH of the Main Pit water. Seeps from the Main Pit containing the acidic water are impacting the unnamed tributaries of Hawes creek. Hawes Creek flows generally south and discharges into Strom Thurmond Lake.

In December of 2003, the SCDHEC performed a site investigation. The investigation found elevated levels of arsenic, cobalt, copper, cyanide, iron, lead, manganese, selenium and zinc in surface water, groundwater and soil samples.

The EPA Region IV Emergency Response and Removal Branch (ERRB) On Scene Coordinator (OSC) has requested ERT assistance in completing a Removal Site Evaluation (RSE) regarding the impact to Hawes Creek and ultimately Strom Thurmond Lake under normal weather conditions and during catastrophic weather (hurricane, etc.) over a short term and longer term period.

A6. PROJECT DESCRIPTION AND SCHEDULE

This project involves the gathering of data required to complete the RSE. The project has been split into several parts to accomplish the required goals.

A streamlined bioassessment based on the EPA Rapid Screening Protocol I of the creeks surrounding the site will be performed to delineate the extent of impact. Parameters such as pH and conductivity will be measured. Areas of high sediment deposition will be sampled and submitted for Target Analyte List (TAL) metals, total cyanide, and weak acid dissociable (WAD) cyanide. Water samples will be field screened for the presence of nitrates and sulfates in the surface water using Hach field screening kits.

At the same time, data will be collected to determine a water balance around the main pit and the contaminant loading into a nearby creek due to an observed seep. The water level of the pit will be measured for a period of no less than two months to determine the impact of rainfall events. An elevation survey will be completed to determine the hydraulic head between the pit water level and the seep outfall into the nearby creek. The velocity and cross sectional area of the creek pre and post seep will be investigated and measured to determine the amount of water flowing from the pit into the creek. A visual estimation of the drainage basin into the pit will be determined and mapped using a global positioning system (GPS) device. Research will be performed to determine rainfall and evaporation for this area. Based on the results of these studies, and the historical pit water chemical composition, the contaminant loading into the creek will be estimated. This number will be reevaluated for large storm events such as hurricanes. Other possible failure modes that could lead to further impact to the creek will be investigated.

The process ponds will also be investigated during the field event. The concern is that during a precipitation event, either normal or catastrophic, that there could be a release of the contents of the ponds to the surrounding surface water network. Six-point composite sediment samples of each pond will be taken and analyzed for TAL Metals, total cyanide, and WAD cyanide. An estimation will be made of the sediment quantity in each pond. The available freeboard will be calculated to determine the amount of precipitation that would have to occur to cause the ponds to overflow. The leak detection sumps for each pond will be sampled and submitted for TAL metals, total cyanide, and WAD cyanide.

Process equipment that has not been dismantled will also be investigated. Any tank or drum containing an appreciable quantity of unknown materials will be sampled and a field hazardous waste categorization (HAZCAT) will be performed. Included in this study is any remaining process piping. The exception to this task is any drums, etc., which may be located in the main pit. Due to the highly acidic nature of the pit, such items will not be investigated at this time.

All TAL metals, total and WAD cyanide samples will be sent to an EPA Region IV CLP laboratory for analysis.

The schedule of activities and reports is as follows:

- | | | |
|---|-------------------------------|---------------------------|
| • | Work Plan (WP) | March 16, 2007 |
| • | Health and Safety Plan (HASP) | March 19, 2007 |
| • | Draft QAPP | March 20, 2007 |
| • | Final QAPP | August 17, 2007 |
| • | Field Work | March 26 through 30, 2007 |
| • | Trip Report | June 22, 2007 |

A7. DATA QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT OF DATA

Data collected from this site will be used to load an EPA ORD impact model. Sediments will be evaluated to determine the levels of contaminants that could be released from this site in the case of a catastrophic event. All other data recorded during this site investigation will be used to assist in the loading and development of the model.

Two of the three data categories (DCs) described in the 1993 Office of Solid Waste and Emergency Response (OSWER) Office of Emergency and Remedial Response (OERR) Directive (EPA 1993) will be used for this WA. These DCs will be "Screening Data" (SD) and "Definitive Data" (DD). SD will be used for the collection of "real-time" data. Screening data without definitive confirmation is not considered to be data of known quality. DD will be used for all data collection activities, such as TAL metals, total and WAD cyanide analyses, which require a high level of accuracy using EPA, National Institute for Occupational Safety and Health (NIOSH), the American Society for Testing and Materials (ASTM) and other industry-recognized methods. For the data to be definitive, either total measurement error or analytical error must be determined.

The following requirements for SD are applicable for water quality measurements, air monitoring using a photoionization detector (PID), survey data, sulfate screening, nitrate screening, hazard categorization and all bioassessment observations.

- Sample documentation in the form of field logbooks and appropriate field data sheets. Chain of custody (COC) records are optional for field screening locations.
- All instrument calibration and/or performance check procedures/methods will be summarized and documented in the field/personal or instrument log notebook. The manufacturer's instructions or Standard Operating Procedures (SOPs) should specify the procedure and frequency for calibration during use.
- Detection limit(s) will be determined and documented, along with the data, where appropriate.

The following requirements for DD are applicable for the analysis of TAL metals, total and WAD cyanide for all matrices:

- Sample documentation in the form of field logbooks, the appropriate field data sheets, and chain of custody forms will be provided.
- All instrument calibration and/or performance check procedures/methods will be summarized and documented in the field/personal or instrument log notebook.
- Detection limit(s) will be determined and documented, along with the data, where appropriate.
- Sample holding times will be documented; this includes documentation of sample collection and analysis dates.
- Initial and continuing instrument calibration data will be provided.
- Rinsate blanks, field blanks, collocated samples, trip blanks, duplicate samples, and matrix spikes will be included at the frequency specified in the QA tables in REAC SOP #4016, *Preparation of Work Plans for REAC Activations* depending on the matrix.
- Performance Evaluation (PE) samples are optional.
- Analyte identification will be confirmed on 100 percent (%) of the samples by analytical methods associated with definitive data.
- Quantitation results for all samples will be provided.
- Analytical or total measurement error must be determined on 100% of the samples.
 - **Analytical error** determination measures the precision of the analytical method. At a minimum, two replicate aliquots are taken from a thoroughly homogenized sample or two media blanks, prepared and analyzed in accordance with the method, calculated and compared to method-specific performance criteria.
 - **Total measurement error** is determined from independently collected samples from the same location and analyzed by analytical methods associated with definitive data. Quality control parameters such as the mean, variance, and coefficient of variation is calculated and compared to established measurement criteria.

The data use categories are based on the Data Quality Indicators (DQIs) used to determine the acceptability or usability of the data. Two DQIs used in the laboratory measurement process that will be evaluated during the validation procedure are precision and accuracy.

- Precision is a measure of agreement between replicate measurements under similar conditions and may be expressed as Relative Percent Difference (RPD). In the CLP Laboratory, the RPD will be calculated between a matrix spike (MS) and matrix spike duplicate (MSD). A Percent Difference (%D) or RPD may be calculated between the results of a sample and a field duplicate sample after the measurement process is complete.
- Accuracy is a measure of the agreement between an observed value and an accepted reference value. This will be determined by analyzing a known reference material or a sample to which a specific amount of a known reference material has been added to. Accuracy will be expressed as Percent Recovery (%R). Since accuracy takes into account the effects of variability (precision), accuracy is a combination of bias and precision.

A8. TRAINING AND CERTIFICATION

All REAC field personnel involved with sampling activities shall have the following documented training:

- Occupational Safety and Health Administration (OSHA) 40-hour and 8-hour refresher in Hazardous Waste Operations (20 CFR 1910.120)
- Department of Transportation (DOT) Hazardous Material Shipping
- First Aid and Cardiopulmonary Resuscitation (CPR) training (at least one team member)
- Supervisor Training, 8-hour (20 CFR 1910.120 E4), for those in charge of field activities

A9. DOCUMENTS AND RECORDS

The REAC Program QAPP serves as the basis for this site-specific QAPP. The most current approved version of the QAPP is available to all REAC technical personnel as an uncontrolled copy on the REAC local area network (LAN). All observations noted during field efforts, if any, will be documented in accordance with REAC SOP #4001, *Logbook Documentation*.

Documents and records that will be generated during this project include:

- WP
- QAPP
- HASP
- Chains of Custody
- Final Trip Report
- CLP Analytical Results
- Field Change Form, if required
- Custody Seals

The Trip Report will provide a description of the project, sampling and laboratory procedures and difficulties encountered. Documents will be prepared in accordance with the following REAC SOPs:

REAC SOP #4005	<i>Chain of Custody Procedures</i>
REAC SOP #4006	<i>Preparation of Quality Assurance Project Plans (QAPPs)</i>
REAC SOP #4016	<i>Preparation of Work Plans for REAC Activations</i>
REAC SOP #4017	<i>Preparation of Trip Reports</i>
REAC SOP #4019	<i>Preparation of Preliminary Reports</i>
REAC SOP #4020	<i>Analytical Report Preparation</i>
REAC SOP #4022	<i>Preparation of Tables</i>
REAC SOP #4023	<i>Preparation of Figures</i>
REAC SOP #4024	<i>Preparation of Appendices</i>
REAC SOP #4025	<i>Use and Format of References and Source Material in Reports and Tables</i>
REAC SOP #4026	<i>Use of Numbers in REAC Documents</i>

B. DATA GENERATION AND ACQUISITION

BI. SAMPLING PLAN DESIGN

Each portion of the WA has a unique sampling plan design.

During the bioassessment, the sampling plan design focuses on the unnamed tributary to Hawes Creek that flows westward along the northern edge of the site. In addition to this area, two other areas named in the South Carolina Department of Health and Conservation (SCDHEC) Site Investigation (SCDHEC, 2004) report as Outfall 1 and Outfall 2 will be investigated using the EPA Rapid Assessment Protocol. Each stream will be investigated upstream of the impact area and downstream until it is determined that the stream has not been impacted. Water quality data will be measured using a portable water quality device, YSI or equivalent. Visual observations will be made at locations chosen by ERT or FWS personnel. Sediment samples will be collected at points of observed sedimentation. Visual estimates of sediment area and depth will be recorded. Field data sheets, as given in the Rapid Assessment Protocol, will be completed at each observation location, and the location will be recorded using a GPS device accurate to +/- 1 meter. A reference area will be chosen after field personnel have had the opportunity to visually inspect the site. One possible area is the upstream branch of Hawes Creek before it confluent with the unnamed tributary that is the focus of this study. Water samples will be collected and delivered to the REAC field scientist for analysis of nitrates and sulfates using the portable Hach field screening kits.

The water balance around the pit will require several different types of data acquisition. Water level data will be collected by the installation of an In-Situ Minitroll, Professional Model. The minitroll will be set to record the pressure head on an hourly basis. The Minitroll will be installed inside a 6 to 8-inch diameter pipe to minimize water surface effects and deep enough to ensure that the water level is never below the device. The Minitroll will record pressure changes to ± 0.01 pounds per square inch (psi). The study is interested in the change in water elevations during and after precipitation events. Therefore, an absolute water surface elevation is not required. A relative survey will be conducted to determine the difference in elevation between the surface of the pit and the level of the seep into the creek. This survey will be conducted using a standard survey autolevel which is accurate to ± 0.05 feet. The creek flowrate will be calculated by measuring the creek velocity upstream of the seep to the nearest 0.1 ft/sec and surveying the creek cross section using either the autolevel or a survey tape to the nearest $\frac{1}{2}$ inch. This procedure will be repeated downstream of the seep. The seep flowrate can be calculated by subtracting the upstream flowrate from the downstream flowrate. Lastly, the drainage basin will be estimated by walking the drainage basin with a GPS. The area gained by analyzing the GPS results will yield the drainage basin size.

The process ponds will be evaluated in several ways. The ponds will be surveyed by locating the relative elevations of the four corners of each pond versus the water level in the pond. This data, in conjunction with pond construction drawings, will be used to determine the freeboard available in each pond. Six point composite samples of the sediment in each pond will also be taken. Four samples will be taken around the edge of the pond as accessible using long handled scoops. Two point samples will be taken from the center area of the pond from a John boat using a small ponar. Care will be taken to ensure that at no time will any damage occur to the installed liners. The sediment depth will be estimated by a combination of sounding (a weight tied to a length of string) and core sampling at a minimum of 6 points per pond. The exact method will be chosen on a pond by pond basis based upon the type of sediment experienced. The depths to sediment will be compared with available construction documents for each pond. A composite water sample from each pond will be collected and delivered to the REAC field scientist for analysis of nitrates and sulfates using the portable Hach field screening kits to the nearest 1.0 milligram per liter (mg/L) or part per million (ppm). Water samples will be taken from each of the leak detection sumps located beneath each pond. These water samples will be submitted for TAL metals, total and WAD cyanide. The data will be compared to historical water results to determine if possible breakthrough has occurred.

Process equipment that has not been cleaned and dismantled will be checked for possible hazardous waste contents. A visual estimation of tank size and volume as well as residual volume of material remaining in each tank will be recorded. Prior to any sampling, air monitoring will be performed to ensure worker safety, per the REAC HASP. Samples will be taken from all process equipment using long handled scoops to ensure that there is no confined space entry. The samples will be delivered to a REAC field scientist for HAZCAT. Locations of all samples will be recorded using a GPS if outside, or by written description if located inside of one of the processing buildings.

B2 SAMPLING/MONITORING METHODS

Water Quality Sampling. During the bioassessment, water quality will be measured and recorded for each sample location using a multi-parameter water quality meter at the time surface water samples are collected. Water quality parameters measured include temperature, conductivity, dissolved oxygen (DO) and pH.

Sediment Sampling. Sediment samples will be collected after the bioassessment has been completed to avoid disturbing biota and suspending sediments in the water column. Sediment samples will be collected with a petit ponar grab sampler, eckman dredge or a trowel according to procedures outlined in REAC SOP #2016, *Sediment Sampling*. Three grabs will be collected from each creek sampling location to account for small-scale local variability. Six-point composite samples will be collected from each process pond. Sediment samples will be analyzed for TAL metals, total and WAD cyanide.

Global Positioning System (GPS) Data Collection. Positional data will be collected at each sampling location using a Trimble TSC Surveyor. Real-time data will be collected, collecting a minimum of 60 data points at each sample locations. Geographic information will be used for visual representation of data in site maps.

Sample Volume, Container, Preservation, and Holding Time Requirements. Collecting sufficient sample volume and mass is critical for the analysis of required parameters and the completion of QC determinations, and is dictated by the analytical method and the sample matrix. These activities will follow REAC SOP #2003, *Sample Storage, Preservation, and Handling*. Appropriate volumes, preservation and holding times for the analyses and matrices outlined in the scope of work are summarized in Table 1. All water and sediment samples will require preservation at four degrees centigrade (°C). In addition, water samples for metals analysis will require preservation with a 10% solution of nitric acid to a pH of <2.0. Cyanide water samples will be preserved using NaOH to a pH of >12. The holding time for TAL metals analysis is 6 months with the exception of Mercury. Mercury must be analyzed within 28 days. The holding time for Cyanide analysis is 14 days. All nitrate and sulfate samples will be collected using 1 Liter poly bottles and analyzed within 8 hours.

Sampling Equipment Decontamination. Removing or neutralizing contaminants from equipment, or using new/different equipment between sampling locations, minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances. New equipment (e.g., trowels, scrub brushes) will be used at each sampling location, or decontamination of sampling equipment will be performed between each sampling location either at the sampling location, prior to leaving for the sampling site, or in designated areas on the site. Decontamination procedures will follow REAC SOP #2006, *Sampling Equipment Decontamination*.

Survey Data Collection. Collection of survey data will be performed using a Trimble Autolevel or equivalent. All elevation points will be recorded using a GPS device. All elevation data will be +/- 0.05 feet. Survey data is intended to be used for relative elevations only and will not be compared to any datums previously surveyed.

Air Monitoring Using MultiRAE. For health and safety purposes, air will be monitored per the REAC HASP using a MultiRAE multi gas analyzer using REAC SOP #2139, *Multi-Gas Monitor PGM-50/Photoionization Detector (PID) MultiRAE Plus*.

Nitrate Screening. Nitrates in water samples will be screened using Hach colorimetric field test kits per the Hach standard method included with the kit.

Stream Flowrate Gaging. The flowrate of the stream will be gaged at multiple locations. Where applicable, a stream velocity meter will be used to gage the stream velocity. A tape measure will be used to measure the flow area. Together, these numbers can be used to calculate the flow rate. In cases where the velocity meter is not applicable, and the entire flow of the stream can be captured, a known volume will be collected and the time recorded to calculate flow rate.

Sulfate Screening. Sulfates in water samples will be screened using Hach colorimetric field test kits per the Hach standard method included with the kit.

HAZCAT. Samples for which HAZCAT will be performed will be screened on site per the HAZCAT/Chemical Identification System User's Manual and the HAZCAT Field Guide. All samples will be tested for pH and then for specific classes of compounds (i.e., oxidizers, flammable, cyanide, etc.).

B3. SAMPLE HANDLING AND CUSTODY

Each sample collected will receive a unique identifier, which will be indicative of the location from which it was collected. Chain of custody records will be used to document the collection of all samples as they are collected. The chain of custody summarizes and identifies the sampling date, sampling location, sample number, type of container, volume collected, and analyses to be conducted. Chain of custody records will be generated for each shipping cooler. All chain of custody records will receive a peer review in the field prior to shipment of the samples in accordance with REAC SOP #4005, *Chain of Custody Procedures*. At least two custody seals will be placed across the shipping containers to ensure sample integrity. The samples collected by REAC personnel will be shipped to the designated Region IV CLP laboratory for analysis in accordance with REAC SOP #2004, *Sample Packaging and Shipment*. Per the request of the EPA Region IV OSC, all samples will be recorded on chain of custody records generated using Forms II Lite.

B4. ANALYTICAL METHODS

The following statement of work (SOW) will be used by the Region IV designated CLP laboratory.

- Multi-Media, Multi-Concentration Inorganic Analyses. ILM 05.3/ILM 05.4
-

B5. QUALITY CONTROL

Field QC samples are designed to assess the variability of the matrix or medium being sampled and to detect contamination and sampling error in the field. The following field QC samples will be collected for this project:

- Field replicates will be taken for 10% of the samples collected. Field replicates are field samples obtained from one location, homogenized, and divided into separate containers. They are treated as separate samples throughout the remaining sample handling and analytical processes. These samples are used to assess error (precision) associated with sample heterogeneity, sampling methodology and analytical procedures.
- Rinsate blanks will be collected at a rate of one per piece of equipment per day for non-dedicated sampling equipment. Rinsate blanks are samples obtained by pouring distilled/deionized water over decontaminated sampling equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated in the same manner as the samples collected to determine if the contamination is due to improper decontamination procedures.
- Field blanks will be collected at the frequency of one per day per matrix. Field blanks are designed to detect potential sample contamination that may occur during field operations or during shipment. A field blank is primarily used to evaluate contamination error associated with field operations and shipping but may also be used to evaluate contamination error associated with laboratory procedures. Field blanks will be prepared in the field by filling the appropriate sample container with certified clean sand or deionized/distilled water then submitted to the laboratory for analysis.
- Sufficient mass or volume will be collected for the matrix spike/matrix spike duplicate (MS/MSD) analyses with the frequency of one in 20 samples.

Laboratory QC samples are analyzed in the laboratory and are used to determine any matrix effects and to assess the performance of the laboratory. The following laboratory QC samples will be analyzed for this project:

- MS at the frequency of one in 20 samples.
- Method blank at the frequency of one per batch not to exceed 20 samples of the same matrix
- Additional operational QC samples required by the analytical method (e.g., tunes, surrogates, initial and continuing calibrations)
- Laboratory control sample (LCS) at the frequency of one in 20 samples.
- Sample Duplicate every 20 samples.

B6. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

The ability to generate data of known quality is dependent on the maintenance of equipment and analytical instrumentation on a routine and as needed basis. Preventive maintenance actions are taken to prevent instruments from failing during use, to ensure proper instrument performance, and to increase the reliability of the measurement system. Typically, maintenance is initiated when the QC requirements of the method are not met, previous experience with the instrument indicates maintenance should be performed, manufacturer's recommendations, a schedule determined by each group, or prior to and after monitoring and sampling. Each piece of equipment and analytical instrument is assigned a preventive maintenance logbook. All maintenance activities are recorded in this logbook and include the following information: date of service, person/vendor performing the service, type of maintenance performed and the reason, parts replaced, and any

other pertinent information. In addition, an ample supply of spare parts are maintained by each group to minimize downtime of the equipment/instruments. Each piece of equipment will be checked operationally prior to deployment.

Repairs are defined as any unscheduled service or maintenance required on equipment or instrumentation that cannot be handled by REAC personnel. Any repairs made on equipment or instrumentation is also documented in the preventive maintenance log. The service or work order should be taped in the logbook, and signed and dated across the tape.

The MultiRAE PID will be used at the site to monitor air quality within the breathing zone and also to screen subsurface soil samples. The PID will be maintained and tested monthly in accordance with REAC SOP #2139, *Multi-Gas Monitor PGM-50/Photo-Ionization Detector (PID) MultiRAE Plus*.

B7. INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

There are two types of calibration: operational and periodic. Operational calibration is routinely performed as part of instrument usage, such as development of a standard curve. Periodic calibration is performed at prescribed intervals, such as balances and ovens and is relatively stable in performance.

Operational calibration is generally performed as part of the analytical procedure and is dependent upon the type of instrumentation. Typically, certified standards with certificates of analysis are used to prepare calibration standards for analytical instruments. Preparation of a standard curve is accomplished by using calibration standards containing the species to be analyzed into a specific solvent mixture to be introduced into the instrument. The concentrations of the working standards are chosen to cover the working range of the instrument. The calibration curve is prepared by plotting instrument response versus the concentration of the standards. Concentrations of the samples analyzed are read directly from the calibration curve or determined by interpolation.

Instrument calibration typically consists of two types: initial calibration and continuing calibration. Initial calibration procedures establish the calibration range of the instrument and determine the instrument response over that range. The instrument response may be area counts, peak height, or absorbance, and is expressed as a % relative standard deviation (RSD) or a correlation coefficient. Continuing calibration measures the instrument response to a single calibration standard, and the response is compared with the initial calibration. Continuing calibration may be used as a single point within a 12 hour period, or every 10 samples, depending on the analyte to be measured.

Periodic calibration is performed on equipment required for analytical methods, but not routinely calibrated as part of the analytical procedure. Analytical balances are calibrated on an annual basis by an external agency. Balances are routinely calibrated using Class "S" weights that are purchased with a certificate of traceability. Several National Institute of Standards and Technology (NIST) reference thermometers are used to calibrate the working thermometers in refrigerators, freezers, and ovens. Glass thermometers are compared with the NIST thermometers every 12 months. Metal and probe-type thermometers are calibrated on a quarterly basis.

All field instruments are initially factory calibrated. The water quality meter will also be field calibrated daily according to the manufacturer's instructions. No field calibration is required for the Trimble TSCe GPS Datalogger. However, the settings should be checked daily to ensure that the proper settings are being used according to the manufacturer's instructions.

The MultiRAE PID will be calibrated by qualified field personnel on a daily basis (before use) using isobutylene as the calibration standard.

The stream velocity meter will be calibrated in accordance with manufacturer's recommendations prior to use.

B8. INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

It is the responsibility of the EPA/ERT to provide adequate facilities, equipment and supplies for REAC to perform all field related tasks for this WA. REAC personnel are responsible for the procurement, inspection, and acceptance of

supplies and consumables for this WA. It will be the responsibility of the CLP laboratory to inspect and accept supplies and consumables for the analytical portion of this project.

B9. NON-DIRECT MEASUREMENTS

Historical data will be used by the ERT WAM and EPA Region IV personnel to complete the data required for the RSE. EPA Region IV personnel will be responsible for the usability of this historical data to determine its relevance to the project.

B10. DATA MANAGEMENT

Samples will be delivered under COC to the Region IV designated CLP laboratory. The date, time and sample temperature will be recorded on the COC record. Samples will be identified by the field assigned number. The incoming samples will be checked against the chain of custody for accuracy and assigned a unique laboratory number, which identifies the sample to the laboratory personnel. This number can later be cross-referenced to the field number.

GPS data will be directly acquired, processed using Pathfinder Office software, and transferred into a project database. Contaminant data will be received electronically, as well as in hard copy form, from the analytical laboratories and transferred into a project database. In all cases, data entered into the project database will be reviewed and verified for accuracy.

All analytical and field data will be tabulated and summarized in the Final Data Summary Report. Hard and/or electronic copies of the data reports will be provided to the WAM on request. All deliverables and other relevant project information will be submitted in electronic format to the site-specific ERT Information Management System (IMS) website.

Individual WA project files are maintained in a central repository known as Central File. All documents associated with WA 0-247 will be submitted to Central File and be identified by the WA number, project name (Barite Hill Gold Mine Site), and type of document. Documents filed will include the WA, WP, QAPP, Final Data Summary Report, field notebooks, copies of logbook entries, maps, and any presentations which may be generated. Electronic copies of the deliverables will be archived in accordance with Administrative Procedure (AP) #34, *Archiving Electronic Files*, and saved on the REAC archive drive. Hard and electronic copies of all deliverables will remain permanently in REAC Central File and in the REAC archive folder once a WA is closed. Central Files are organized and maintained by Support Services personnel. Access to Central Files is regulated to ensure the integrity and completeness of the files, and retrieval of documents from the Central File can only be done through Support Services Personnel.

C. ASSESSMENT/OVERSIGHT

C1. ASSESSMENT AND RESPONSE ACTIONS

The TL/QC Coordinator, Operations Section Leader and QAO are responsible for QA assessments and corrective action for this WA. The tasks associated with this QAPP may be assessed through the use of peer reviews, and management system reviews. Peer review enables the reviewers to identify and correct reporting errors before reports are submitted. Management system reviews establish compliance with prevailing management structure, policies and procedures, and ensures that the required data are obtained. All project deliverables will receive an internal peer review prior to release, per guidelines established in the REAC AP #22, *Peer Review of REAC Deliverables*.

The EPA/ERT WAM or assigned liaison for this task will be present during the site field work and will have the responsibility for verifying that the proper SOPs and sampling procedures are followed. If any technical issues or deficiencies are identified, they will be reported to the REAC TL for immediate resolution or corrective action. Any changes in scope of work will be documented on a WA Field Change Form and approved by the WAM.

C2. REPORTS TO MANAGEMENT

REAC Report	Recipients
Monthly Progress	EPA/ERT Project Officer and WAM
Quality Assurance Quarterly Reports	EPA/ERT Project Officer and QA Manager

D. DATA VALIDATION AND USABILITY

D1. DATA REVIEW, VERIFICATION AND VALIDATION

All data produced under this QAPP will be evaluated to determine compliance with the stated collection methods, type, and number of samples collected, sample handling, and correct analytical procedures. Data review will be conducted in the laboratory prior to data release to evaluate the validity of the sample batch. Two data quality indicators, precision and accuracy, will be used to assess the batch. Data verification is the steps taken to determine whether the quality requirements specified in the "B" elements of this QAPP have been met. Data verification will be performed by the REAC TL/QC Coordinator. For field activities, it is necessary to determine whether the samples were collected using the sampling design specified in element B1, whether the samples were collected according to a specific method or SOP as specified in element B2, whether the collected samples have been recorded and handled properly as in element B3, and whether the proper amount of QC samples were taken to satisfy the QC requirements specified in element B5. For analytical activities, each sample should be verified by the CLP laboratory to ensure that the procedures used to generate the data (as specified in element B4) were performed as specified. The proper amount of QC checks (as specified in element B5) that were prepared and analyzed during the actual analysis provide an indication of the quality of the data. Instrument calibrations (as specified in element B7) are evaluated to determine whether the correct number of calibration standards were used and the range of the analysis, whether standards were analyzed in an appropriate sequence specific to the methods used, and were performed prior to the analysis of samples, blanks and QC samples in an appropriate time frame.

D2. VERIFICATION AND VALIDATION METHODS

Data verification occurs at each level in the field and in the laboratory to ensure that appropriate outputs are being generated routinely. Records produced electronically or maintained as hard copies are subject to data verification. During field activities, records associated with sample collection such as field data sheets, COC records, shipper's air bills, logbook documentation, or electronic devices to log samples or print sample labels are verified against approved SOPs or procedures. At sample receipt, COC records are verified along with refrigerator and freezer logs to ensure the integrity of the samples. During sample preparation, digestion/extraction logs, certificates of analysis for surrogates and spiking compounds, refrigerator and freezer logs, analytical requests and standard preparation logs are verified. Manufacturer's certificates for calibration and/or internal standards, instrument run or injection logs, standard preparation logs, calculation worksheets, and QC sample results are verified during the analysis of the sample set. It is assumed that the Regional Environmental Services Assistance Team (ESAT) will validate the data in accordance with the National Functional Guidelines for Inorganic Data Review.

D3. RECONCILIATION WITH USER REQUIREMENTS

Responsibility lies with the EPA, thus, this element is not applicable to this QAPP.

REFERENCES

Response Engineering and Analytical Contract . 2003. *Quality Assurance Project Plan for the Response Engineering and Analytical Contract*.

United States Environmental Protection Agency (EPA). 2001. *EPA Requirements for Quality Assurance Project Plans (QAPPs)*, EPA/240/B-01/003, Office of Environmental Information.

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EPA. 1999. *Rapid Bioassessment Protocols for Use In Streams and Wadeable Rivers*, Second Edition, EPA/841/B-99/002, Office of Wetlands, Oceans and Watersheds

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TABLE 1. Field Sampling Summary
Barite Hill Gold Mine Site - McCormick, SC

Analytical Parameter	Action Level ¹	Matrix	Container Type and Volume (# Containers req'd)	Preservative	Holding Times	Subtotal Samples	QC Extras				Total Field Samples ⁶
							Rinsate Blanks ²	Field/Trip Blanks ³	PE Samples ⁴	Total Matrix Spikes ⁵	
TAL Metals	NA	SD	8 ounce glass jar (1)	4°C	6 months 28 Days for Mercury	30	NA	3/0	NA	3	33
TAL Metals	NA	SW	1000 mL poly bottle	4°C; HNO ₃ to pH<2	6 months 28 Days for Mercury	10	NA	1/0	NA	1	11
Total Cyanide	NA	SD	8 ounce glass jar	4°C	14 Days	30	NA	3/0	NA	3	33
Total Cyanide	NA	SW	1000 mL poly bottle	4°C; NaOH to pH>10.2	14 Days	10	NA	1/0	NA	1	11
WAD Cyanide	NA	SD	8 ounce glass jar	4°C	14 Days	30	NA	3/0	NA	3	33
WAD Cyanide	NA	SW	1000 mL poly bottle	4°C; NaOH to pH>12	14 Days	10	NA	1/0	NA	1	11
Sulphates	NA	SW	1000 mL poly bottle	4°C	NA	30	NA	NA	NA	NA	30
Nitrates	NA	SW	1000 mL poly bottle	4°C	NA	30	NA	NA	NA	NA	30

NOTES: * Matrix: SD = Sediment, SW=Surface Water; NA = Not Applicable, SD = Screening Data, SD/DC = Screening Data with Definitive Confirmation, DD = Definitive Data, TAL=Target Analyte List, mL = milliliter, L=liter, °C=Degrees Centigrade, HNO₃=Nitric Acid

1. The concentration level, specific or generic, needed to make an evaluation. This level will provide a basis for determining the analytical method to be used.
2. If dedicated sampling tools are not used, rinsate blanks are required for the aqueous matrix. They are optional for the soil matrix.
3. Field blanks are required for aqueous and nonaqueous matrices. Aqueous field blanks are prepared with distilled/deionized water and nonaqueous field blanks are prepared with clean sand or soil. One blank required per day.
4. Performance evaluation samples are optional for SD/DC and DD at one per parameter per matrix. For SD, enter "NA."
5. Ensure that a sufficient volume of environmental sample is collected for lab spiking. All analyses conducted at the REAC laboratories require matrix spike samples at a frequency of ≥ 10 percent of the total samples, regardless of data category. In addition, for SD/DC and DD: Determine bias (percent recovery) using a minimum of two matrix spikes. Determine precision using a minimum of eight matrix spikes.
6. Add the numbers of rinsate blanks, field blanks, trip blanks, and PE samples to the subtotal number of samples to determine this.

TABLE 2. QA/QC Analysis and Data Categories Summary
Barite Hill Gold Mine - McCormick, SC

			Matrix Spikes		QA/QC	
Analytical Parameter	Matrix*	Analytical	Lab ¹	Additional ²	Detection Limits ³	Data Category ⁴
TAL Metals	SD	ILM 05.3/ ILM 05.4	3	NA	0.1 - 500 mg/kg ⁵	DD
TAL Metals	SW	ILM 05.3/ ILM 05.4	1	NA	0.2- 5000 µg/L ⁶	DD
Cyanide	SD	ILM 05.3/ ILM 05.4	3	NA	2.5 mg/kg ⁵	DD
Cyanide	SW	ILM 05.3/ ILM 05.4	1	NA	10 µg/L ⁶	DD
VOCs, HCn, Ammonia	Air	REAC SOP #2139	NA	NA	1 ppm	SD
Nitrates	SW	Hach Manual	NA	NA	1 ppm	SD
Sulfates	SW	Hach Manual	NA	NA	1ppm	SD
pH	SW	Modified SW-846	NA	NA	1-14 S.U.	SD

NOTES: * Matrix: SD=Sediment, SW=Surface Water, SD = Screening Data, ppm = Parts per Million, S.U. = Standard units, DD = Definitive Data

1. Ensure that a sufficient volume of environmental sample is collected for lab spiking. All analyses conducted at the REAC laboratories require matrix spike samples at a frequency of ≥ 10 percent of the total samples, regardless of data category.
2. For SD/DC and DD: Determine bias (percent recovery) using a minimum of two matrix spikes. Determine precision using a minimum of eight matrix spikes. Laboratory matrix spikes may be utilized to fulfill these additional QC requirements.
3. To be determined by the person arranging the analysis. Should be equal to or less than the action level.
4. Enter data category desired: SD, SD/DC, DD.
5. Assuming required amount of sample is submitted. Limit listed above is without total solids or dilution factor corrections.
6. Assuming required amount of sample is submitted. Limit listed above is without dilution factor corrections.